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(54) Card type fuse and method of producing the same

Sicherung in Kartenbauart und Verfahren zu ihrer Herstellung

Fusible du type à carte ainsi que méthode pour sa fabrication

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- **PATENT ABSTRACTS OF JAPAN vol. 16, no. 112 (E-1180)19 March 1992 & JP-A-03 285 230 (SUMITOMO)**

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Description

This invention relates to a method of producing a card type fuse in which fuse circuits are arranged on an insulation substratum and in which a cover layer covers the fuse circuits.

Such a card type fuse is known from for instance JP-A-03 285 230.

A card type fuse is suitable for use in various devices having a low electrical power of less than 1A. For example, such a fuse is suitable for fuse-matching in a wire harness composed of wires having a small diameter, and which connects, for example, a series of electronic elements in a car. In such fields, utilization of card type fuses has been increasing.

For instance, in a harness for a motor car, a card type fuse is employable with reduced diameter wires and has an advantage in that it has a small capacity. Electronic elements in cars are required to connect various kinds of devices and include a number of small capacity fuses. As such, card type fuses are advantageous since they can arrange many small capacity fuses.

Ease of connection to a wiring harness has promoted the use of card type fuse-equipped connectors or the like. Such a connector is located not only in special fuse boxes but also in various kinds of devices. The connector is suitable for use with a multiple connections having a small size, thus enabling a car to be provided with numerous electronic devices.

In addition, heretofore, a low melting point metal (lead, zinc, lead-tin alloy) or a high melting point metal (silver, copper) has been used as a fuse element. However, use of a low melting point metal makes it difficult to produce a fuse having a small diameter. On the other hand, use of a high melting point metal is inappropriate in that a melting point higher than that required is provided. Such a high melting point metal cannot release a circuit upon over-heating and thus makes it difficult to produce a low power circuit. In view of the above, the card type fuse is the most suitable for use in a small sized fuse circuit carrying a low current.

In Japanese Patent Publication No. 59-42479 (1984), a card type fuse is disclosed which is produced by the steps of: forming a fuse circuit on a substratum (e. g., copper-glass epoxy substratum) for a circuit sold in a market through a stainless mask in an exposuring manner; vaporizing the low melting point metal such as tin and the like on the fuse circuit; and coating the fuse circuit with a heat resisting film such as polyester (PET), polyimide (PI) or the like by using an adhesive.

However, manufacture of the above card type fuse is both time and cost inefficient and makes it difficult to precisely design an exothermic fusing portion.

An object of the present invention is to provide a method for producing a card type fuse which enjoys reduced production costs and exhibits improved forming characteristics for an exothermic fusing portion.

To achieve this object, in accordance with the present invention, we provide a method for producing a card type fuse in which fuse circuits having a narrow exothermic fusing portion are arranged on an insulation substratum and a cover layer covers the fuse circuits, characterised by the steps of:

printing the fuse circuits on a heat resisting film by using a conductive paste;
inserting the heat resisting film thus treated into a metal forming mold;
supplying into said metal forming mold a heat resisting thermoplastic resin suitable for SMT; and
forming the heat resisting thermoplastic resin into the insulation substratum in such a manner that the substratum is integral with the fuse circuits and the cover layer of heat resisting film.

With the card type fuse produced by the method of the present invention, it is possible to improve accuracy in forming the fuse circuits and exothermic fusing portion, since the fuse circuits are formed by being printed with a conductive paste.

Since the insulation substratum made of the heat resisting thermoplastic resin is suitable for SMT and is formed integrally on the side of the heat resisting film having the printed fuse circuits, it is not necessary to provide an additional covering layer, and the heat resisting film serves as a covering layer. Consequently, the number of production steps is reduced and production costs are accordingly lowered.

Figure 1 is an enlarged cross sectional view of a main part of an embodiment of a card type fuse produced in accordance with the process of the present invention;
Figure 2 is a plan view of the embodiment in Figure 1.

Referring now to the drawings an embodiment of a card type fuse produced in accordance with the method that is the subject of the present invention will be explained. Figure 1 shows an enlarged cross sectional view of the card type fuse formed on a print substratum and Figure 2 shows a plan view of a main part of the card type fuse.

In Figures 1 and 2, an insulation substratum 1 is formed by cutting into a desired shape a heat resisting thermoplastic resin suitable for SMT which is suitable for heat-forming, such as polyether-etherketone (PEEK), thermoplastic polyimide (PI), polyphenylene sulfide (PPS), polyamide, polyetherimide, polyarylate, liquid crystal polymer, polyester (PET, PBT), polyamide (nylon 6, 66, 46, MXD6), or the like.

These heat resisting thermoplastic resins may be selected from one of materials from non-reinforced materials to filler-reinforced materials and preferably are glass-reinforced material containing 20 to 40% of glass.

Fuse circuits 2 are integrally formed and transferred

on one side of the insulation substratum 1 and each of the fuse circuits has a narrow exothermic fusing portion 2a. When an over current flows in the fuse circuits 2, the exothermic fusing portions 2a are fused at a temperature over their melting point and cut off, thereby turning off the circuits 2.

The fuse circuits 2 are formed by screen-printing or silk-printing the conductive paste on one side of the heat resisting film to be a covering layer 3.

The conductive paste may be a low melting point metal such as lead, zinc lead-tin alloy, and the like, a high melting point metal such as silver, copper and the like, or a low melting point binary eutectic alloy or a low melting point multisystem eutectic alloy, which are combined by the low and high melting point metals.

The heat resisting film which forms the covering layer 3 may be a polyester film, a polyimide film, a polyamideimide film, an epoxy film, or the like, which have heat resisting characteristics.

The covering layer 3 is adhered to the insulation substratum upon molding.

An embodiment of the method of producing the card type fuse will now be described. A heat resisting film made of the PET film or the like and having a given dimension is prepared beforehand (10). The fuse circuits 2 are formed on one side of the heat resisting film by screen-printing or silk-printing of the conductive paste (20).

The heat resisting film with printed fuse circuits 2 is inserted into a forming metal mold and a heat resisting thermoplastic resin suitable for SMT such as PPS or the like is supplied in the mold on the side with the fuse circuits 2 to integrally form the card type fuse (30).

Thus, the card type fuse is integrally formed and the fuse circuits 2 are transferredon the insulation substratum 1 made of the heat resisting thermoplastic resin suitable to the SMT and the heat resisting film serves as the covering layer 3 for the fuse circuits 2 (40).

As described above, according to the card type fuse and the method of producing the same in the embodiment of the present invention, since the fuse circuits 2 are printed on the heat resisting film by means of the conductive paste, the fuse circuits 2 are accurately formed on the film, so that the exothermic fusing portions 2a are also accurately formed.

Now, in screen-printing with the conductive paste, a printed line with a width of less than 0.3 mm is sufficient for practical use. The printed line has a precision of about ± 50 μm in width and a maximum thickness of 10 μm. This can be fully applied to a fuse.

Also, since the insulation substratum 1 is integrally formed on the side with the fuse circuits 2 on the heat resisting film, it is possible to utilize the heat resisting film as the covering layer 3 without providing it with another covering layer by using an adhesive or the like. Consequently, it is possible to reduce the number of producing steps and associated costs.

A method for integrally forming a heat resisting thermoplastic resin suitable for SMT may be a projecting mold method, a flow stamping method, an NC blow method, an SP mold method, a heat-press method or the like, which can insert the heat resisting film-with the fuse circuits 2 into the forming metal mold.

The forming metal mold may have a shape suitable for receiving the heat resisting film. The card type fuse may be of any convenient shape.

For example, the card type fuse may be formed by using PPS with a glass fiber content of 40% as the heat resisting thermoplastic resin suitable for the SMT, and using a projection molding device having a clamping force of 60 tons; inserting the PET film with the fuse circuits 2 printed with the conducting solder paste beforehand into the forming metal mold; and projecting the PPS into the mold by the device under conditions in which a temperature at the top of a nozzle of a projection cylinder is 320°C, a projection pressure is 800 kg/cm^2, and a temperature in the metal mold is 110°C.

It will be apparent from the foregoing that forming accuracies of the fuse circuits and exothermic fusing portions are improved since the fuse circuits are formed by printing with the conductive paste in the present invention. It is possible to reduce the number of production steps and costs, since the insulation substratum made of the heat resisting thermoplastic resin suitable for SMT is integrally formed on the side of the heat resisting film having the fused circuits printed thereon.

Claims

1. A method for producing a card type fuse in which fuse circuits (2) having a narrow exothermic fusing portion (2A) are arranged on an insulation substratum (1) and a cover layer (3) covers the fuse circuits (2), characterised by the steps of:

   printing the fuse circuits (2) on a heat resisting film (3) by using a conductive paste;
   inserting the heat resisting film (3) thus treated into a metal forming mold;
   supplying into said metal forming mold a heat resisting thermoplastic resin suitable for SMT; and
   forming the heat resisting thermoplastic resin into the insulation substratum (1) in such a manner that the substratum (1) is integral with the fuse circuits (2) and the cover layer (3) of heat resisting film.

Patentansprüche

1. Verfahren zur Herstellung einer Sicherung der Kartenbauart, bei dem einen engen exothermischen Sicherungsabschnitt (2a) aufweisende Sicherungsschaltungen (2) auf einem Isoliersubstrat (1) ange-

ordnet werden und eine Deckschicht (3) die Sicherungsschaltungen (2) bedeckt, gekennzeichnet durch die Schritte:

Aufdrucken der Sicherungsschaltungen (2) auf einen hitzebeständigen Film (3) unter Verwendung einer leitfähigen Masse;

Einsetzen des in dieser Art behandelten hitzebeständigen Films (3) in eine Form zum Metallformen;

Zuführen eines hitzebeständigen thermoplastischen Harzes geeignet für SMT in die Form zum Metallformen; und

Verformen des hitzebeständigen thermoplastischen Materials in das Isoliersubstrat (1) in solch einer Weise, daß das Substrat (1) mit den Sicherungsschaltungen (2) und mit der Deckschicht (3) aus hitzebeständigem Film eine Einheit bildet.

Revendications

1. Méthode de production d'un fusible du type à carte ou des circuits fusibles (2) ayant une portion de fusion exothermique étroite (2a) sont agencés sur un substrat isolant (1) et une couche de recouvrement (3) couvre les circuits fusibles (2), caractérisée par les étapes de :

   imprimer les circuits fusibles (2) sur un film thermorésistant (3) en utilisant une pâte conductrice;
   insérer le film thermorésistant (3) ainsi traité dans un moule de mise en forme en métal;
   fournir, dans ledit moule de mise en forme en métal, une résine thermoplastique thermorésistante appropriée pour SMT; et
   former la résine thermoplastique thermorésistante en substrat isolant (1) de manière que le substrat (1) soit intégral avec les circuits fusibles (2) et la couche de recouvrement (3) en film thermorésistant.

Fig. 1

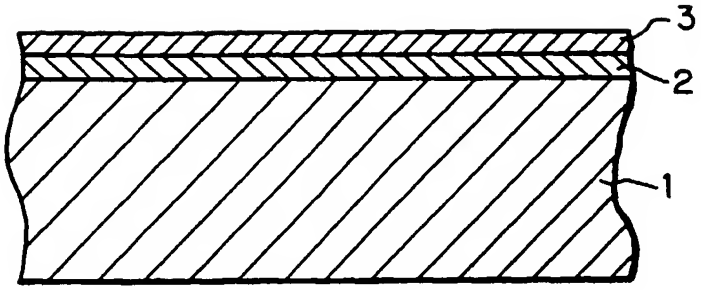

Fig. 2